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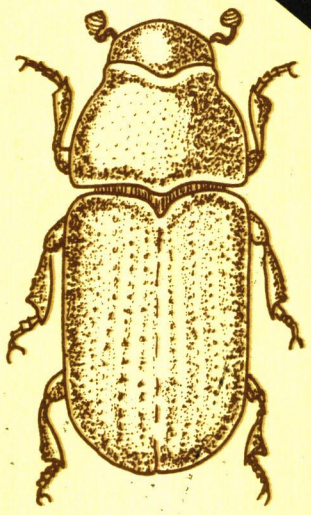
BIOLOGICAL EVALUATION R-3 77-10

SIMULATED YIELD TABLES FOR DWARF MISTLETOE MANAGEMENT IN PONDEROSA PINE STANDS (SWYLD2 PROGRAM)

PHASE II. EVEN-AGED STANDS

Long Valley Ranger District
Coconino National Forest
Arizona

1977



Southwestern Region

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1977

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INTRODUCTION

Timber volume reduction caused by dwarf mistletoe in an infested stand is difficult to assess by direct observation. Also, management alternatives that reduce dwarf mistletoe losses vary in their effectiveness. Researchers have developed a simulated yield program (SWYLD2) for use in even-aged and two-storied ponderosa pine stands. The program aids land managers by quantifying effects of dwarf mistletoe and effects of various silvicultural treatments on a mistletoe infestation.

The SWYLD2 program is being evaluated for implementation in the Southwestern Region by personnel from the Forest Insect and Disease Management Staff Unit. In 1975 and 1976, areas were selected in various parts of the Region for development of simulated yield tables in mistletoe-infested stands. The program for implementation of SWYLD2 consists of three phases: I. Synthesis of yield tables for selected stands infested with dwarf mistletoe, II. Evaluation of these stands managed with the aid of SWYLD2 simulations, and III. Implementation of SWYLD2 as a tool in developing timber management programs in mistletoe-infected stands in Region 3. Technical Report R-3 76-22 provides background information on Phase I of the SWYLD2 program for the area covered in this report.

OBJECTIVE

The purpose of this evaluation was to determine whether management activities simulated by the SWYLD2 computer program (e.g., thinning and dwarf mistletoe control) adequately reflect on-the-ground management in an even-aged ponderosa pine stand on Long Valley Ranger District, Coconino National Forest. Information from this report also will be useful in planning future management of the sampled stand. This report summarizes Phase II of the SWYLD2 implementation program on Long Valley Ranger District.

PROCEDURE

1. Following implementation of management activities (precommercial thinning) simulated in Phase I, data were collected to provide simulations of the stand after silvicultural treatment.

2. Data were combined with management alternatives selected by the land manager prior to the silvicultural treatment and simulated yield tables for the stand after thinning were developed.

3. Comparable yield tables were provided to the land manager to aid in future management of the stand.

METHODS

Personnel from the Forest Insect and Disease Management Staff Unit sampled the stand using the same basic survey procedure as was used in Phase I (see Technical Report R-3 76-22). However, site index and average age measurements were not resampled. Survey results were combined with various management alternatives and processed through the SWYLD2 program.

RESULTS AND DISCUSSION

Survey results apply only to the 171-acre stand on Long Valley Ranger District delineated in Phase I (Technical Report R-3 76-22). A summary of stand conditions before and after the silvicultural treatment follows:

Stand condition	Before	After
Site index	71	71
Average age	60	60
Average number of trees/acre	538	297
Average d.b.h. (inches)	5.7	6.2
Percent trees infected with dwarf mistletoe	35	16

Contract specifications called for an average of 400 leave trees per acre on "thinning only" areas and 225 leave trees per acre in "thinning and piling" areas. An average of 241 trees per acre were removed during the thinning operation, leaving 297 trees per acre. On an average per-acre basis, the residual stand appears to coincide with contract specifications for number of leave trees. Prior to the thinning, 188 trees per acre were infected with dwarf mistletoe. A total of 139 mistletoe-infected trees per acre were removed during the thinning. Overall, the residual stand now has 49 infected trees per acre and 248 non-infected trees per acre. Dwarf mistletoe-infected trees were left in the thinned stand because of spacing restrictions and a maximum diameter limit of 5.5 inches d.b.h.

Four simulated yield tables were selected for use as examples in this report (Tables 1-4). The initial thinning level in all four examples reflects the current on-the-ground situation. Tables 2 and 4 (line 1) simulate the stand after thinning at age 60, rather than actually displaying the reduction in tree numbers as in Tables 1 and 3 (lines 1-2). Variation in tree numbers after the initial thinning resulted from computer rounding in Tables 1 and 3. Subsequent thinning intensities were at growing stock level (GSL) 90 (Tables 1 & 2) and 100 (Tables 3 & 4). All other management alternatives were held constant for the examples. All simulations were based on a 3-cut shelterwood cutting method and projected yields over a 160-year rotation (biological age).

Reduction of dwarf mistletoe levels resulting from selection against infected trees without regard to spacing or diameter limits was simulated (Tables 1 & 3). The actual mistletoe level, based on post-thinning survey results, was also simulated (Tables 2 & 4). Sixteen percent of the residual trees are infected in the stand following thinning operations. The percent trees infected is converted to stand DMR, which is based on the 6-class mistletoe rating system.

Extreme volume reduction occurred because of the relatively high level of dwarf mistletoe remaining in the stand after thinning (Table 1 vs. 2 and 3 vs. 4). Dwarf mistletoe must be reduced sufficiently in the first stand entry to result in a slow buildup, which can then be controlled by subsequent silvicultural treatments (Tables 1 & 3). Failure to reduce mistletoe levels (DMR), initially, results in a relatively rapid buildup, which often cannot be controlled by later stand entries (Tables 2 & 4). Land managers should note that the rate of spread for dwarf mistletoe in even-aged stands increases as stand density decreases, until trees are at least 20 feet apart.

Total board-foot yields were increased when GSL 100, rather than 90, was simulated for the subsequent thinning intensity in a stand where mistletoe was controlled (Table 1 vs. 3). When dwarf mistletoe was not controlled initially (Tables 2 & 4), a subsequent GSL of 90 or 100 made no difference in total board-foot yields. Both GSL's were equally ineffective in reducing dwarf mistletoe losses.

CONCLUSIONS AND RECOMMENDATIONS

Management activities, simulated by the SWYLD2 computer program, were compared with on-the-ground management in an even-aged ponderosa pine stand on Long Valley Ranger District. Sufficient stand data were collected in a post-thinning survey for production of SWYLD2 stand simulations. The evaluation was completed by comparing pre-thinning and post-thinning stand simulations. These simulations were used to compare two subsequent thinning intensities, as well as simulated dwarf mistletoe control versus actual mistletoe control.

When dwarf mistletoe was controlled, subsequent GSL 100, rather than 90, resulted in a higher total board-foot volume production over the rotation. In comparing effects of dwarf mistletoe control, the simulated reduction in mistletoe levels resulted in substantially higher total board-foot yields (5,700 and 6,800 bd. ft.) than the actual level of control. Spacing restrictions and a diameter limit contributed to the difference in board-foot yields. Selection against mistletoe-infected trees, regardless of spacing and diameter restrictions, is essential to maximizing volume production in southwestern ponderosa pine stands. Examination of yield tables will aid land managers in selecting the combination of management alternatives that best meet future management objectives.

Results of this report indicate the following alternatives are available to Long Valley Ranger District:

Alternative 1: Within 5 years, complete a sanitation thinning to reduce dwarf mistletoe levels in the residual stand.

Alternative 2: a) Make additional simulations for the present stand conditions to determine the degree of mistletoe control resulting from reduction of subsequent thinning levels below GSL 90; b) if adequate mistletoe control and acceptable yields can be obtained by thinning to a lower subsequent GSL, implement that level of thinning during the next stand entry.

Alternative 3: Do nothing and accept projected timber volume losses.

Utilization of the SWYLD2 program to aid in decision-making on other even-aged or two-storied ponderosa pine stands on Long Valley Ranger District is recommended. Personnel from the Forest Insect and Disease Management Staff Unit will provide assistance in implementing the SWYLD2 program on a District-wide basis. Funding may be available from FIDM for collecting stand data necessary for input into the SWYLD2 program.

LITERATURE CITED

Walters, J. W., and B. W. Geils. 1976. Simulated yield tables for dwarf mistletoe management in ponderosa pine stands (SWYLD2 program). Tech. Rep. R-3 76-22. 20 pp.

YIELDS PER ACRE OF SOUTHWESTERN PONDEROSA PINE, STAND NUMBER 19752.

SITE INDEX 71
THINNING INTENSITY-- INITIAL- 84. SUBSEQUENT- 90.

COCONINO NF LONG VALLEY RD AS THINNED BUT DM REDUCED

CHARACTERISTICS BEFORE AND AFTER THINNING									PERIODIC INTERMEDIATE CUTS				
STAND AGE (YEARS)	DMR	TREES NO.	BASAL AREA SQ.FT.	AVERAGE D.B.H. IN.	AVERAGE HEIGHT FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.	TREES NO.	BASAL AREA SQ.FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.
60	.4	538	95	5.7	50	1870	800	0					
60	.0+	298	60	6.1	51	1180	620	0	240	35	690	180	0
70	.2	296	86	7.3	58	1800	1330	0					
80	.2	294	110	8.3	64	2470	2050	1300					
80	.0+	211	85	8.6	64	1910	1620	1300	83	25	560	430	0
90	.1	210	106	9.6	69	2640	2340	4000					
100	.2	209	126	10.5	73	3390	3070	8000					
100	.0+	139	90	10.9	74	2450	2230	6500	70	36	940	840	1500
110	.1	139	107	11.9	77	3100	2850	10200					
120	.1	139	124	12.8	81	3760	3500	13000					
120	.0+	48	54	14.4	82	1680	1580	6400	91	70	2080	1920	6600
130	.1	48	65	15.8	85	2110	2000	8600					
140	.1	48	77	17.1	88	2550	2440	11100					
140	.0+	14	27	18.8	89	920	890	4300	34	50	1630	1550	6800
150	.1	14	33	20.7	92	1150	1110	5800					
160	.1	14	39	22.5	94	1390	1350	7600					
							TOTAL YIELDS				7290	6090	22500

MERCH. CU. FT. - TREES 6.0 INCHES D.B.H. AND LARGER TO 4.0-INCH TOP.
BD. FT. - TREES 10.0 INCHES D.B.H. AND LARGER TO VARIABLE TOP LIMIT.
INITIAL THINNING MUST BE FROM BELOW.
DWARF MISTLETOE RATING ABOVE WHICH PERIODIC THINNINGS WILL NOT BE EXECUTED - 3.0.
MINIMUM CUTS FOR INCLUSION IN TOTAL YIELDS-- 260. CUBIC FEET AND 500. BOARD FEET.
PRECOMMERCIAL INITIAL THINNING ALLOWED. NONCOMMERCIAL SUBSEQUENT THINNINGS NOT ALLOWED.
AT INITIAL AGE 60., 35. PERCENT OF THE TREES WERE INFECTED WITH DWARF MISTLETOE.

Table 1

YIELDS PER ACRE OF SOUTHWESTERN PONDEROSA PINE, STAND NUMBER 1976.

SITE INDEX 71
THINNING INTENSITY-- INITIAL- 90. SUBSEQUENT- 90.

COCONINO NF LONG VALLEY RD YELLOWJACKET AS THINNED AND AS DM ACTUALLY REDUCED

CHARACTERISTICS BEFORE AND AFTER THINNING									PERIODIC INTERMEDIATE CUTS				
STAND AGE (YEARS)	DMR	TREES NO.	BASAL AREA SQ.FT.	AVERAGE D.B.H. IN.	AVERAGE HEIGHT FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.	TREES NO.	BASAL AREA SQ.FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.
60	.2	297	62	6.2	50	1180	650	0					
70	.6	295	88	7.4	57	1810	1360	0					
80	1.1	293	113	8.4	63	2480	2080	1500					
80	.6	208	86	8.7	63	1900	1620	1400	85	27	580	460	100
90	1.0	207	106	9.7	68	2620	2330	4200					
100	1.9	190	116	10.6	72	3100	2810	7500					
100	1.5	139	90	10.9	73	2410	2190	6400	51	26	690	620	1100
110	2.3	126	97	11.9	76	2760	2550	9100					
120	3.1	110	100	12.9	79	2980	2770	10400					
120	2.3	49	54	14.2	81	1640	1540	6100	61	46	1340	1230	4300
130	3.0	43	57	15.6	84	1800	1710	7300					
140	3.7	37	58	17.0	86	1900	1820	8200					
140	2.8	15	28	18.4	87	920	890	4300	22	30	980	930	3900
150	3.6	15	34	20.3	90	1150	1120	5800					
160	4.4	15	40	22.1	92	1400	1370	7500					
							TOTAL YIELDS				4990	4610	16800

MERCH. CU. FT. - TREES 6.0 INCHES D.B.H. AND LARGER TO 4.0-INCH TOP.
BD. FT. - TREES 10.0 INCHES D.B.H. AND LARGER TO VARIABLE TOP LIMIT.
INITIAL THINNING MUST BE FROM BELOW.
DWARF MISTLETOE RATING ABOVE WHICH PERIODIC THINNINGS WILL NOT BE EXECUTED - 3.0.
MINIMUM CUTS FOR INCLUSION IN TOTAL YIELDS-- 260. CUBIC FEET AND 500. BOARD FEET.
PRECOMMERCIAL INITIAL THINNING ALLOWED. NONCOMMERCIAL SUBSEQUENT THINNINGS NOT ALLOWED.
AT INITIAL AGE 60., 16. PERCENT OF THE TREES WERE INFECTED WITH DWARF MISTLETOE.

Table 2

YIELDS PER ACRE OF SOUTHWESTERN PONDEROSA PINE, STAND NUMBER 19752.

SITE INDEX 71
THINNING INTENSITY-- INITIAL- 84. SUBSEQUENT- 100.

COCONINO NF LONG VALLEY RD AS THINNED BUT DM REDUCED

		CHARACTERISTICS BEFORE AND AFTER THINNING							PERIODIC INTERMEDIATE CUTS				
STAND AGE (YEARS)	DMR	TREES NO.	BASAL AREA SQ.FT.	AVERAGE D.B.H. IN.	AVERAGE HEIGHT FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.	TREES NO.	BASAL AREA SQ.FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.
60	.4	538	95	5.7	50	1870	800	0					
60	.0+	298	60	6.1	51	1180	620	0	240	35	690	180	0
70	.2	296	86	7.3	58	1800	1330	0					
80	.2	294	110	8.3	64	2470	2050	1300					
80	.0+	239	94	8.5	64	2110	1780	1300	55	16	360	270	0
90	.1	237	117	9.5	69	2910	2570	4300					
100	.2	235	136	10.3	73	3660	3300	8100					
100	.0+	163	100	10.6	74	2700	2450	6500	72	36	960	850	1600
110	.1	163	118	11.5	77	3380	3100	11200					
120	.1	163	135	12.3	80	4050	3750	13600					
120	.0+	58	60	13.8	82	1860	1740	6800	105	75	2190	2010	6800
130	.1	58	72	15.1	85	2310	2190	9100					
140	.1	58	84	16.3	87	2790	2650	11700					
140	.0+	17	30	18.1	89	1030	990	4700	41	54	1760	1660	7000
150	.1	17	37	19.9	91	1280	1240	6300					
160	.1	17	43	21.6	93	1550	1510	8200					
							TOTAL YIELDS				7510	6300	23600

MERCH. CU. FT. - TREES 6.0 INCHES D.B.H. AND LARGER TO 4.0-INCH TOP.
BD. FT. - TREES 10.0 INCHES D.B.H. AND LARGER TO VARIABLE TOP LIMIT.
INITIAL THINNING MUST BE FROM BELOW.
DWARF MISTLETOE RATING ABOVE WHICH PERIODIC THINNINGS WILL NOT BE EXECUTED - 3.0.
MINIMUM CUTS FOR INCLUSION IN TOTAL YIELDS-- 260. CUBIC FEET AND 500. BOARD FEET.
PRECOMMERCIAL INITIAL THINNING ALLOWED, NONCOMMERCIAL SUBSEQUENT THINNINGS NOT ALLOWED.
AT INITIAL AGE 60., 35. PERCENT OF THE TREES WERE INFECTED WITH DWARF MISTLETOE.

Table 3

YIELDS PER ACRE OF SOUTHWESTERN PONDEROSA PINE, STAND NUMBER 1976.

SITE INDEX 71
THINNING INTENSITY-- INITIAL- 100. SUBSEQUENT- 100.

COCONINO NF LONG VALLEY RD YELLOWJACKET AS THINNED AND AS DM ACTUALLY REDUCED

		CHARACTERISTICS BEFORE AND AFTER THINNING							PERIODIC INTERMEDIATE CUTS				
STAND AGE (YEARS)	DMR	TREES NO.	BASAL AREA SQ.FT.	AVERAGE D.B.H. IN.	AVERAGE HEIGHT FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.	TREES NO.	BASAL AREA SQ.FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.
60	.2	297	62	6.2	50	1180	650	0					
70	.6	295	88	7.4	57	1810	1360	0					
80	1.1	293	113	8.4	63	2480	2080	1500					
80	.7	235	95	8.6	63	2090	1770	1500	58	18	390	310	0
90	1.1	233	117	9.6	68	2880	2550	4500					
100	2.0	212	125	10.4	72	3310	3000	7500					
100	1.6	160	100	10.7	72	2660	2420	6600	52	25	650	580	900
110	2.4	143	105	11.6	76	2970	2720	9600					
120	3.3	123	105	12.5	79	3110	2880	10600					
120	2.5	59	60	13.7	80	1820	1710	6700	64	45	1290	1170	3900
130	3.3	51	63	15.0	83	1970	1860	7700					
140	4.0	43	62	16.3	86	2020	1930	8500					
140	3.1	18	31	17.7	87	1020	980	4500	25	31	1000	950	4000
150	3.5	18	37	19.5	89	1270	1230	6200					
160	3.8	18	44	21.2	91	1540	1500	8000					
							TOTAL YIELDS				4870	4510	16800

MERCH. CU. FT. - TREES 6.0 INCHES D.B.H. AND LARGER TO 4.0-INCH TOP.
BD. FT. - TREES 10.0 INCHES D.B.H. AND LARGER TO VARIABLE TOP LIMIT.
INITIAL THINNING MUST BE FROM BELOW.
DWARF MISTLETOE RATING ABOVE WHICH PERIODIC THINNINGS WILL NOT BE EXECUTED - 3.0.
MINIMUM CUTS FOR INCLUSION IN TOTAL YIELDS-- 260. CUBIC FEET AND 500. BOARD FEET.
PRECOMMERCIAL INITIAL THINNING ALLOWED. NONCOMMERCIAL SUBSEQUENT THINNINGS NOT ALLOWED.
AT INITIAL AGE 60., 16. PERCENT OF THE TREES WERE INFECTED WITH DWARF MISTLETOE.

*FIN

Table 4